

Exhibit P

GLOBAL
EDITION



Modern Industrial Organization

FOURTH EDITION

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ALWAYS LEARNING

PEARSON

If fixed costs are not sunk, the shutdown decision depends on whether revenues exceed *avoidable* costs. An example (in Chapter 2) of an avoidable cost is the lawyer who can pay a penalty to break a lease. If some fixed costs are avoidable, a price equal to AVC^* is not high enough to prevent the firm from shutting down. Use the numbers from above and suppose that the fixed cost of \$200 represents a yearly rental payment and that, for a \$100 penalty fee, the landlord will release the lawyer from the obligation to pay \$200. The firm compares losing \$100 for sure (the penalty fee) with producing and earning revenues minus production costs minus the \$200 rental payment. If price is \$10, the firm earns \$0 per sale and is stuck paying the \$200 of fixed cost; therefore, it prefers to pay the \$100 penalty and go out of business. Even if price were \$10.50 so that the firm would make 50¢ on each of its 100 units sold, it would still be better to pay the \$100 penalty and go out of business.

The price at which shutdown occurs is above average variable cost and closer to average cost the greater the proportion of fixed costs that are avoidable. In the extreme, when there are no sunk costs (all fixed costs are avoidable), the shutdown point coincides with the minimum point on the AC curve. Thus, if it has no sunk costs, a firm shuts down before it incurs economic losses.

The Competitive Market

Given the behavior of individual competitive firms, we can derive a market supply curve. The intersection of the market supply curve and the market demand curve determines the competitive equilibrium.

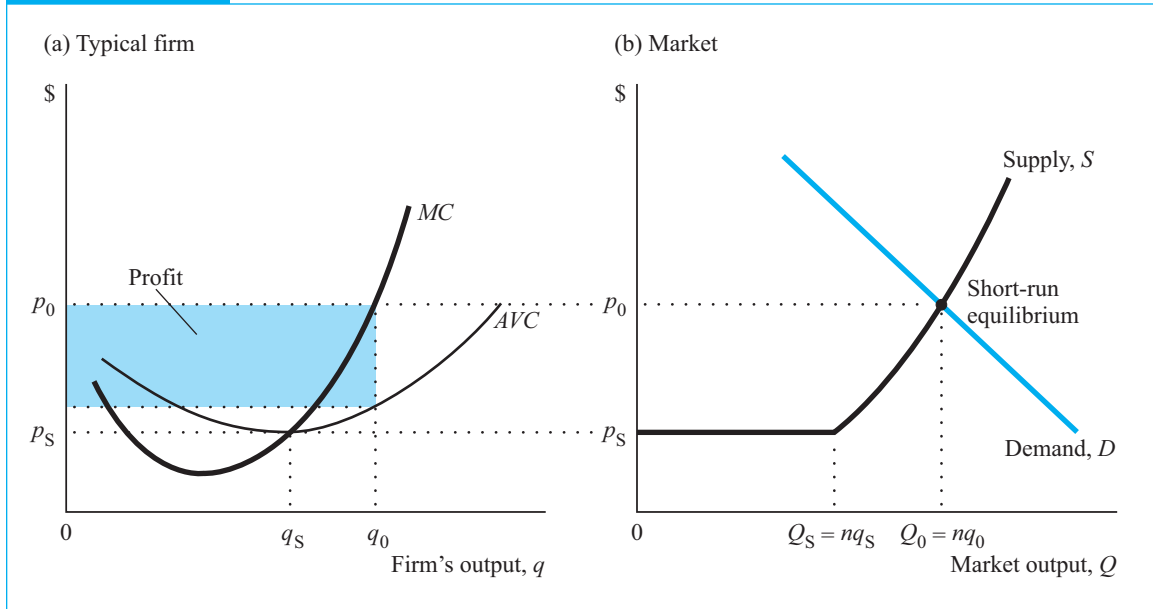
The Short-Run Equilibrium. We start by supposing that there are n identical firms and that all fixed costs are sunk in the short run. The short-run **market supply curve**, S in Figure 3.2b, is the horizontal sum of the supply curves of each firm, the MC curve above the minimum of the AVC curve in Figure 3.2a. The horizontal portion of the market supply curve reflects (1) that no output is forthcoming if price is below the shutdown point and (2) that at a price slightly above the shutdown point, all firms produce.

The intersection of the demand curve with the short-run market supply curve determines the *short-run equilibrium price*, p_0 , and quantity, Q_0 . The amount that firms want to supply at the equilibrium price exactly equals the amount that consumers demand at that price. There are no unsatisfied buyers and no unsatisfied sellers. All buyers pay and all sellers receive the same price.

In the short-run equilibrium in Figure 3.2, a typical firm may earn a profit, which provides an incentive for firms to enter the market. However, such entry cannot occur in the short run because firms cannot build new plants in the short run.

The Long-Run Equilibrium. In the long run, firms can adjust their levels of capital so that they can enter this market. Short-run profits or losses induce firms to enter or leave the market until price is driven to the minimum long-run average cost, AC^* , in the long run.

In Figure 3.2, firms are making a positive profit at the short-run equilibrium price p_0 , which is determined by the intersection of the market demand curve and the original short-run market supply curve. In the long run, these profits induce new firms to

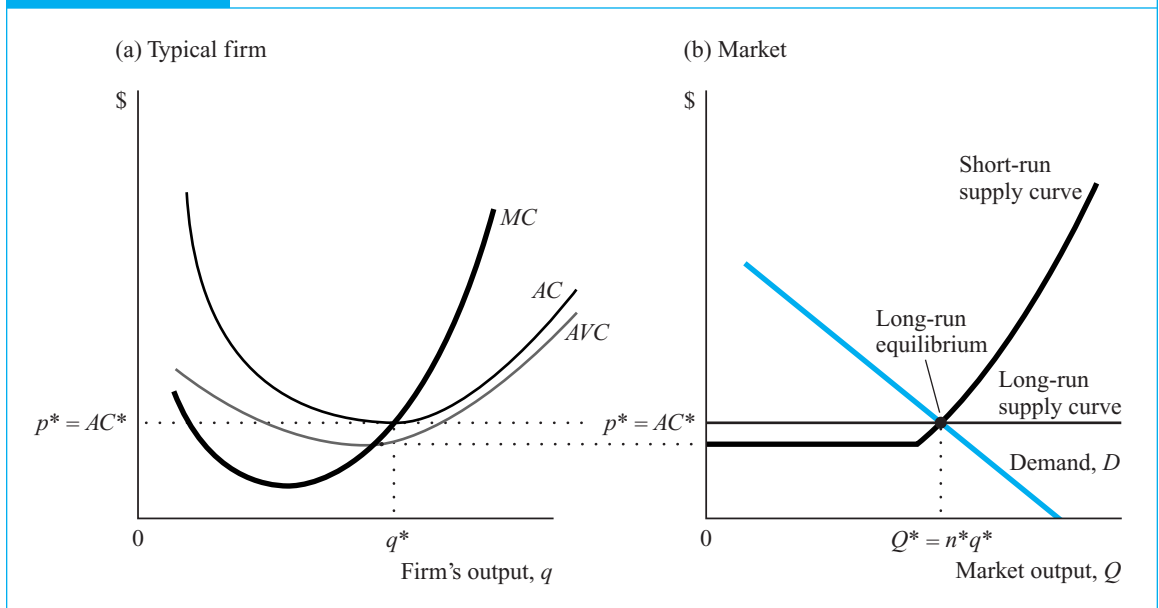
FIGURE 3.2**Short-Run Equilibrium**

enter this market. If the number of firms that can potentially produce at the same cost is very large, the long-run supply curve is horizontal at the minimum of the average cost curve, AC^* , as Figure 3.3 shows. The long-run equilibrium is determined by the intersection of the demand curve and the long-run market supply curve. In Figure 3.3, the market is in a new short-run *and* long-run equilibrium because the demand curve, D , intersects both the long-run supply curve and the new short-run supply curve corresponding to the equilibrium number of firms, n^* . The equilibrium price is $p^* = AC^*$, and equilibrium output is $Q^* = n^*q^*$. In this long-run equilibrium, firms make zero profit.

Similarly, short-run losses induce firms to leave the market and reduce output until price rises again to yield normal (zero) profits. In long-run equilibrium, firms receive economic profits of zero, which is just enough to induce them to remain in the market.

The Slope of the Long-Run Supply Curve. In this last example, a very large number of firms could enter the market and produce at the same marginal and average costs as the existing firms. Consequently, the long-run perfectly competitive supply curve was perfectly flat at AC^* , which is the minimum average cost of production. However, the long-run supply curve need not be flat.

If an expansion of output causes the prices of some key inputs to rise, the long-run supply curve tends to be upward sloping. As the output of wheat produced increases, farmland becomes more valuable, and the land rents (or the opportunity cost of owning the land) increase. As rents increase, the average cost curve of each farmer rises so the minimum average cost, AC^* , increases. Thus, the long-run supply curve for the

FIGURE 3.3**Long-Run Equilibrium**

wheat market (whose height is traced out by the minimum average cost points) rises as output expands.

Whenever some factors of production (such as fertile land) are in fixed supply, their price gets bid up as market output expands. Prices of key inputs may fall as output expands if there are economies of scale. If input prices fall as output expands, the long-run market supply curve could slope down. The long-run supply curve of a market tends to be flat as long as the market accounts for only a small fraction of any one factor's total employment.

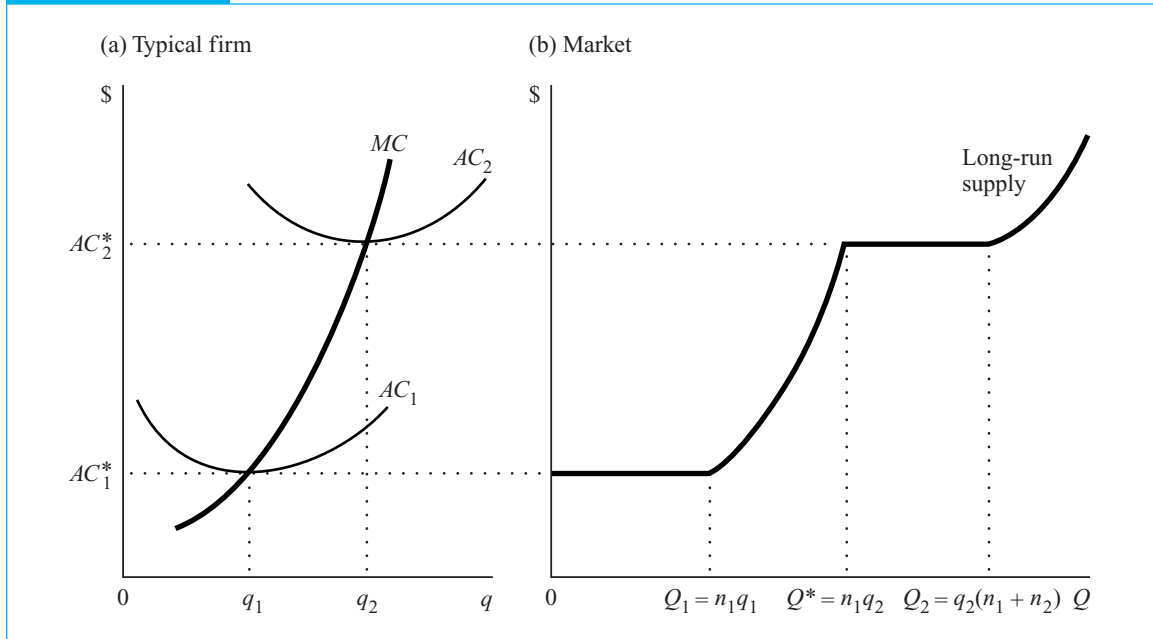
Another reason why the long-run supply curve may be upward sloping is that there are only a few firms that can produce at low costs. For market output to increase, less efficient firms have to enter the market. In Figure 3.4a, there are n_1 low-cost, efficient firms with marginal cost curve MC and average cost curve AC_1 . The minimum point on AC_1 is AC_1^* , which is obtained if the firm produces q_1 units of output. For market output levels up to $Q_1 = n_1q_1$, these low-cost firms can produce at the minimum average cost, AC_1^* , so the long-run supply curve is flat at AC_1^* up to Q_1 , as Figure 3.4b shows. If less than Q_1 is demanded, some of these n_1 firms exit the market.

If the market demand is slightly larger than Q_1 , the average cost of production must rise. The market supply curve is the horizontal sum of the supply curves of the n_1 firms: Their marginal cost curves above AC_1^* . Thus, because there are no more low-cost firms, the market supply curve rises beyond Q_1 .

Now suppose that there are n_2 other firms that can produce this product with the same marginal cost curve as the n_1 firms but with an average cost curve, AC_2 , with a higher minimum average cost, $AC_2^* (> AC_1^*)$. That is, these high-cost firms have larger fixed costs than do the low-cost firms.

FIGURE 3.4

Upward-Sloping Long-Run Supply Curve



If the quantity demanded is slightly greater than $Q^* = n_1 q_2$, the price is AC_2^* and some high-cost firms enter the market. Increases in market demand beyond this point are met by additional high-cost firms entering the market and producing q_2 at an average cost of AC_2^* . When the quantity demanded can no longer be met by entry by additional high-cost firms, the long-run supply curve again rises, tracing out the sum of the marginal cost curves of all the firms in the market. That is, the long-run supply curve rises for output greater than $Q_2 = Q^* + n_2 q_2 = q_2(n_1 + n_2)$.

If the quantity demanded exceeds $n_1 q_1$ but is less than Q^* (that is, the second group of firms has not entered the market), the low-cost firms earn an unusual return (profit) to their scarce knowledge or other scarce resource that enables them to produce at relatively low costs. That is, they earn a **rent**: a payment to the owner of an input beyond the minimum necessary to cause it to be used. If the quantity demanded exceeds Q_2 , both types of firms earn rents on their scarce know-how or other scarce input.⁵

⁵In some markets where firms must incur substantial sunk costs so that only a few firms can efficiently produce, a competitive equilibrium may be impossible. In such markets where no competitive equilibrium exists, the market exhibits instability, including price wars and bankruptcies. Here, firms may temporarily make above-normal profits; these profits attract other firms, the additional competition results in all the firms in the market making losses, some firms exit, the remaining firms make above-normal profits, and the process repeats. The study of when interactions between firms and consumers will lead to stability is called the theory of the core. See Clark (1923), Telser (1978), and www.aw-bc.com/carlton_perloff "Nonexistence of Competitive Equilibrium."